What is claimed is:

1. A magneto-optical indicator element comprising:

a substrate; and

a thin film indicator structure comprising a plurality of thin-film layers disposed on a said substrate, at least one of said layers comprising magneto-optically (MO)-active material having predetermined magnetic properties including magnetic anisotropy, magnetization saturation value, coercive field value; and a magneto-optical effect value; said indicator structure including at least one of said layers having a thickness and/or refractive index modulated in a predetermined fashion; said indicator structure having at least one optical mode which is at least partially localized within and/or at at least one interface of said at least one MO-active layer; said at least one optical mode being at least partially localized in said one layer having modulated thickness and/or refractive index.

2. The magneto-optical indicator element of claim 1 wherein said thickness and/or refractive index modulation provides a one-dimensional optical grating.

3. The magneto-optical indicator element of claim 1 wherein said thickness and/or refractive index modulation provides a two-dimensional optical grating.

4. The magneto-optical indicator element of claim 1 wherein said thickness and/or refractive index modulation provides any predetermined number of superimposed optical gratings.

5. The magneto-optical indicator element of claim 4 wherein the superimposed gratings are collinear, one-dimensional gratings.

6. The magneto-optical indicator element of claim 4 wherein superimposed gratings are non-collinear, one-dimensional gratings.

7. The magneto-optical indicator element of claim 1 wherein the optical mode comprises a surface plasmon mode.

8. The magneto-optical indicator element of claim 7 wherein at least one magneto-optically-active layer provides a single surface that supports .the surface plasmon mode.

9. The magneto-optical indicator element of claim 8 wherein the magneto-optical film has an operational wavelength range, and the MO-active layer exhibits a positive real part of dielectric permittivity in the operational wavelength range of the magneto-optical indicator film.

10. The magneto-optical indicator element of claim 9 wherein said at least one layer has a modulated thickness made of metal selected from the group consisting of: Ag, Au, Al, and Cu.

11. The magneto-optical indicator element of claim 9 wherein said film comprises at least two layers with modulated thickness made of metals selected from the group consisting of: Ag, Au, Pd Al, Cu.

12. The magneto-optical indicator element of claim 9 wherein the MO-active layer is selected from the group consisting of:

iron garnets modified with at least one element selected from the group consisting of Bi, Y, Ga, Ce;

iron garnets modified with at least one element selected from the group consisting of rare earth elements;

intermetallic compounds and alloys;

ferromagnetic oxides;

magnetic semiconductors.

13. The magneto-optical indicator element of claim 12 wherein the substrate comprises a monocrystalline substrate.

14. The magneto-optical indicator element of claim 1 wherein the MO-active layer comprises a single crystal layer.

15. The magneto-optical indicator element of claim 14 wherein the MO-active layer possesses magnetic anisotropy chosen from the group consisting of: in-plane anisotropy, perpendicular anisotropy, cubic anisotropy, easy-plane anisotropy.

16. The magneto-optical indicator element of claims 1 wherein the thickness-modulated metal layer is made in the form of self-assembled ordered colloids made of metal selected from the group, consisting of: Ag, Au, Al, Cu.

17. The magneto-optical indicator element of claim 8 wherein said MO-active layer comprises ferromagnetic material.

18. The magneto-optical indicator element of claim 17 wherein further comprises a thin layer of metal having a thickness of no more than 15 nm and selected from the group, consisting of: Ag, Al, Au, Cu disposed contiguous to said layer of ferromagnetic material.

19. The magneto-optical indicator element of claim 18 wherein said thin layer of metal has a modulated thickness.

20. The magneto-optical indicator element of claim 18 wherein said thin layer of metal has a constant thickness.

21. The magneto-optical indicator element of claim 20 wherein said metal layer of modulated thickness is disposed adjacent to a thin layer of metal on a side opposite to the MO-active layer.

22. The magneto-optical indicator element of claim 20 wherein a sufficiently transparent layer of material with a spatially modulated refractive index is disposed adjacent to the thin layer of metal on the side opposite to the substrate.

23. The magneto-optical indicator element of claim 22 wherein said layer of modulated thickness is made of transparent dielectric material.

24. The magneto-optical indicator element of claim 17 wherein said ferromagnetic layer is made with modulated thickness.

25. The magneto-optical indicator element of claim 1 wherein the optical mode is a localized surface plasmon mode.

26. The magneto-optical indicator element of claim 25 wherein said localized surface plasmon mode is at least partially localized in the at least one MO-active layer.

27. The magneto-optical indicator element of claim 26 wherein the MO-active layer possesses a positive real part of dielectric permittivity in the operational wavelength range of the magneto-optical indicator film.

28. The magneto-optical indicator element of claim 26 wherein the at least one layer with a modulated thickness is a metal, selected from the group, consisting of: Ag, Au, Al, Cu.

29. The magneto-optical indicator element of claim 26 wherein the MO-active layer is selected from the group consisting of:

iron garnets modified with at least one element selected from the group consisting of Bi, Y, Ga, Ce;

iron garnets modified with at least one element selected from the group consisting of rare earth elements;

intermetallic compounds and alloys;

ferromagnetic oxides;

magnetic semiconductors.

30. The magneto-optical indicator element of claim 29 wherein the substrate comprises a monocrystalline substrate.

31. The magneto-optical indicator element of claim 30 wherein the MO-active layer comprises single crystal layer.

32. The magneto-optical indicator element of claim 31 wherein the MO-active layer possesses magnetic anisotropy chosen from the group consisting of: in-plane easy-axis anisotropy, perpendicular anisotropy, easy-plane anisotropy and cubic anisotropy.

33. The magneto-optical indicator element of claim 28 wherein the thickness modulation is made in the form of self-assembled ordered colloids made of metal selected from the group consisting of: Ag, Au, Al, Cu.

34. The magneto-optical indicator element of claim 28 wherein the thickness modulation is made in the form of self-assembled, unordered colloids made of metal selected from the group consisting of: Ag, Au, Al, Cu.

35. The magneto-optical indicator element of claim 28 wherein the thickness modulation is made in the form of a fractal structure.

36. The magneto-optical indicator element of claim 28 wherein the thickness modulation is made in the form of a self-affine structure.

37. The magneto-optical indicator element of claim 1 wherein the optical mode is a waveguide mode.

38. The magneto-optical indicator element of claim 37 wherein said waveguide mode is at least partially localized in the at least one MO-active layer.

39. The magneto-optical indicator element of claim 38 wherein the MO-active layer possesses a positive real part of the dielectric permittivity in the operational wavelength range of the magneto-optical indicator film.

40. The magneto-optical indicator element of claim 39 wherein the at least one layer with a modulated thickness is made of dielectric material that is transparent in the operational wavelength range of the magneto-optical indicator film.

41. The magneto-optical indicator element of claim 39 wherein the MO-active layer is selected from the group consisting of:

iron garnets modified with at least one element selected from the group consisting of Bi, Y, Ga, Ce;

iron garnets modified with at least one element selected from the group consisting of rare earth elements;

intermetallic compounds and alloys;

ferromagnetic oxides;

magnetic semiconductors.

42. The magneto-optical indicator element of claim 39 wherein the substrate is a monocrystalline substrate.

43. The magneto-optical indicator element of claim 42 wherein the MO-active layer is single crystal layer.

44. The magneto-optical indicator element of claim 43 wherein the MO-active layer possesses magnetic anisotropy chosen from the group consisting of: in-plane easy-axis anisotropy, perpendicular anisotropy, easy-plane anisotropy.

45. The magneto-optical indicator element of claim 40 wherein the thickness modulation is made in the form of self-assembled, ordered colloids made of dielectric material that is transparent in the operational wavelength range of the magneto-optical indicator film.

46. The magneto-optical indicator element of claim 1 wherein the optical mode is a hybrid surface plasmon mode.

47. The magneto-optical indicator element of claim 1 wherein a magneto-optical indicator element is arranged adjacent to a specimen being observed and between the substrate and the specimen.

48. The magneto-optical indicator element of claim 47 wherein said indicator film is provided with a protective layer on the side adjacent to the specimen.

49. The magneto-optical indicator element of claim 47 in which an anti-reflection coating is provided on the side of the substrate opposite to the specimen.

50. The magneto-optical indicator element of claim 49 wherein a reflective layer is applied between the MO-active layer and the protective layer.

51. The magneto-optical indicator element of claim 50 wherein an adhesion-promoting layer is applied between the MO-active layer and the reflective layer.

52. The magneto-optical indicator element of claim 1 wherein the influence of the specimen on the magneto-optical indicator element is evaluated with respect to optical polarization at the frequency of the illuminating light.

53. The magneto-optical indicator element of claim 1 wherein the influence of the specimen on the magneto-optical indicator element is evaluated with respect to optical reflectivity at the frequency of the illuminating light.

54. The magneto-optical indicator element of claim 1 wherein the influence of the specimen on the magneto-optical indicator element is evaluated with respect to optical phase at the frequency of the illuminating light.

55. The magneto-optical indicator element of claim 1 wherein the influence of the specimen on the magneto-optical indicator film is evaluated with respect to optical polarization, phase and reflectivity at the frequency of the illuminating light.

56. The magneto-optical indicator element of claim 1 wherein the influence of the specimen on the magneto-optical indicator element is evaluated with respect to optical polarization at the doubled frequency of the illuminating light.

57. The magneto-optical indicator element of claim 1 wherein the indicated parameter is the magnetization of the specimen.

58. The magneto-optical indicator element of claim 1 wherein the indicated parameter is the distribution of electrical currents in the specimen.

59. The magneto-optical indicator element of claim 1 wherein the indicated parameter is the distribution of magnetic flux from the specimen.

60. The magneto-optical indicator element of claim 1 wherein the indicated parameter is the distribution of magnetic particles in the specimen.

61. The magneto-optical indicator element of claim 1 wherein the indicated parameter is the distribution of mechanical defects or structural irregularities of the specimen.

62. A method of manufacturing a magneto-optical indicator element comprising:

providing a substrate,

applying, onto said substrate, a thin film indicator structure comprising a plurality of thin-film layers, at least one of said layers comprising magneto-optically (MO)-active material having predetermined magnetic properties including magnetic anisotropy, magnetization saturation value, coercive field value; and a magneto-optical effect value, and

modulating the thickness and/or refractive index of at least one of said layers in a predetermined fashion so that said indicator structure exhibits at least one optical mode which is at least partially localized within and/or at at least one interface of said at least one MO-active layer; said at least one optical mode being at least partially localized in said one layer having modulated thickness and/or refractive index.

63. An optical apparatus comprising:

a light source;

a light detector; and

a magneto-optical indicator element disposed along an optical path between said light source and said light detector, said magneto-optical indicator element comprising a substrate and a thin film indicator structure comprising a plurality of thin-film layers disposed on a said substrate, at least one of said layers comprising magneto-optically (MO)-active material having predetermined magnetic properties including magnetic anisotropy, magnetization saturation value, coercive field value; and a magneto-optical effect value; said indicator structure including at least one of said layers having a thickness and/or refractive index modulated in a predetermined fashion; said indicator structure having at least one optical mode which is at least partially localized within and/or at at least one interface of said at least one MO-active layer; said at least one optical mode being at least partially localized in said one layer having modulated thickness and/or refractive index.